

found the plunge bath exceedingly beneficial and quieting to those suffering with alcoholic pneumonia. Flatulent distention of the abdomen should be avoided, and the pneumonia patient should be given fresh air without stint.

Arteriosclerosis and Its Bearing on Certain Lesions of the Retina and Optic Nerves.—Dr. CHARLES STEDMAN BULL of New York presented this paper. He said that he regarded many cases of so-called chronic glaucoma as the result of atrophy of the nerve from retrobulbar arteriosclerosis. A pressure atrophy of the optic nerve within the cranial cavity might be caused by pressure of diseased and rigid vessels in crossing each other's course. The resulting atrophy of the nerve was at first a pure pressure atrophy; later on there was probably added a secondary proliferation of connective tissue, which caused more extensive atrophy and, perhaps, the formation of new vessels. The therapy of arteriosclerosis was still in its infancy. When the stage was reached at which the evidence could be recognized by the ophthalmoscope, the process must be far advanced. All that could be done was to arrest the progress of the disease and limit its extension. In the long-continued use of iodide of potassium we had an excellent means of arresting or retarding the extension of the process. When the underlying toxic influences were known they should, of course, receive special attention.

Dysmenorrhœa.—Dr. CHARLES BONIFIELD of Cincinnati, Ohio, was the author of this paper. He said that probably the commonest cause of dysmenorrhœa was lack of development of the uterus. Other causes were adhesions of the uterus, exfoliative endometritis, stricture of the cervical canal from the use of caustics, disease of the tubes, and deficient development, adhesions or prolapse of the ovary. Anæmia was, perhaps, the most important of the constitutional causes of dysmenorrhœa. Pain referred to the hypogastric region pointed to a uterine origin; if the pain were greater during the flow, and was not apparently associated with uterine contractions, a constitutional cause might be suspected. Pain in the iliac region pointed to disease of the appendages. If the pain were not very severe, rest in bed and hot drinks and hot baths might be sufficient. In severer cases, drugs would be required. Opium and alcohol should be avoided, because of the danger of establishing a habit. The coal-tar products answered very well as substitutes, and, in his hands, a combination of atropine and sodium bromide had proved very useful. Viburnum prunifolium sometimes acted satisfactorily, but was uncertain. The salicylates were useful in rheumatic individuals. In cases of defective development, thorough dilatation of the cervical canal and curettage should be done, and in addition, the uterus should be packed with gauze, thus producing a miniature labor. Sometimes two or three such curettements would be required at intervals of a few months or a year or two. Malpositions should be attended to.

Properties of the Blood Serum as Illuminated by Ehrlich's Researches.—Dr. RICHARD C. CABOT of Boston gave a most interesting and instructive exposition of this highly intricate subject. He expressed the opinion that there had been no single medical discovery since the promulgation of Virchow's cell doctrine, as important as that comprising the facts and theories springing out of Ehrlich's researches. Until very recent years the blood serum had been looked upon as one of the most uninteresting of tissues. The discovery of Nuttall that the blood serum possessed bactericidal power attracted very little attention until the antitoxic studies of Roux and others. It should be recalled that a toxin was the filtered sterile product of a culture of some pathogenic organism. When such a toxin was injected into the blood, the toxin left the blood, often in a very few minutes. Ehrlich proved that it attached itself to certain body cells, exhibiting in this a selective action. A toxin never poisoned, as strychnine did, while circulating in the blood; its action was made manifest only when it combined with certain cells. The production of antitoxin

in an animal was out of all proportion to the amount of toxin introduced. Ehrlich's ingenious and somewhat fanciful "side-chain" theory was really a metaphor, and was derived from chemical symbols. He conceived that the toxin molecule fitted what he called the receptor, as a key fitted a lock. The organs capable of being poisoned were those having receptors fitted for the reception of the toxins. The receptors were supposed to break off and swim freely in the serum. These receptors were the antitoxin. The ordinary function of the receptor was supposed to be to secure food for the cell. Dr. Cabot then went on to explain in detail the many fascinating features and ramifications of this theory, pointing out some of the medical and medicolegal possibilities resulting from the study of hæmolysis.

At the conclusion of the address, the association extended him a vote of thanks.

Minus Cylinders; Those Who Prescribe Them, and Those Who Wear Them.—Dr. FRANK W. HIGGINS of Cortland read a paper with this title. In it he reported a number of cases of eye-strain that had done very badly under the use of minus cylinders. Incidentally, he paid his respects to the peripatetic opticians and "refractionists," who did so much harm, even when they were honest in their efforts, which was certainly not always the case.

(To be continued.)

Medical Items.

Health Report.—The following cases of smallpox, yellow fever, cholera, and plague have been reported to the Surgeon-General, U. S. Marine Hospital Service, during the week ended October 17, 1903:

SMALLPOX—UNITED STATES.			CASES. DEATHS.	
Alabama, Mobile.....	Oct. 4-10.....	4	0	0
California, Los Angeles.....	Sept. 27-Oct. 3.....	4	0	0
San Francisco.....	Sept. 28-Oct. 4.....	1	0	0
Illinois, Chicago.....	Oct. 4-10.....	3	0	0
Danville.....	Oct. 4-10.....	2	0	0
Maryland, Baltimore.....	Oct. 4-10.....	1	0	0
Michigan, Detroit.....	Oct. 4-10.....	1	0	0
New York, New York City.....	Oct. 4-10.....	4	0	0
Niagara Falls.....	Oct. 4-10.....	2	0	0
Ohio, Cincinnati.....	Oct. 3-9.....	1	0	0
Pennsylvania, Altoona.....	Oct. 4-10.....	1	0	0
Carlisle.....	Oct. 8-14.....	2	0	0
Philadelphia.....	Oct. 4-10.....	11	3	0
Tennessee, Memphis.....	Oct. 4-10.....	2	0	0
Texas, San Antonio.....	Sept. 1-30.....	12	1	0
Utah, Salt Lake City.....	Sept. 27-Oct. 10.....	8	0	0
Wisconsin, Milwaukee.....	Oct. 4-10.....	7	0	0
SMALLPOX—INSULAR.				
Philippine Islands, Manila.....	Aug. 22-20.....	3	1	0
SMALLPOX—FOREIGN.				
Austria-Hungary, Prague.....	Sept. 20-26.....	4	0	0
France, Paris.....	Sept. 20-26.....	1	0	0
Great Britain, Bradford.....	Sept. 20-26.....	3	0	0
New Castle-on-Tyne.....	Sept. 20-26.....	5	0	0
Italy, Catania.....	Sept. 25-Oct. 1.....	1	0	0
Russia, Moscow.....	Sept. 13-19.....	1	0	0
Odessa.....	Sept. 20-26.....	1	0	0
St. Petersburg.....	Sept. 13-19.....	42	0	0
Spain, Barcelona.....	Sept. 13-26.....	4	0	0
YELLOW FEVER—UNITED STATES.				
Texas, Laredo.....	Oct. 7-15.....	180	10	0
Minera.....	Oct. 3-12.....	50	0	0
YELLOW FEVER—FOREIGN.				
Costa Rica, Limon.....	Sept. 25-Oct. 1.....	2	1	0
Mexico, Linares.....	Sept. 6-26.....	446	202	0
Merida.....	Sept. 6-26.....	18	4	0
Nuevo Laredo.....	Oct. 5-13.....	18	4	0
Quintana Roo.....	Sept. 20-26.....	1	0	0
Tampico.....	Sept. 27-Oct. 3.....	1	0	0
Tehuantepec.....	Sept. 6-26.....	6	0	0
Salina Cruz.....	Sept. 6-26.....	4	2	0
Valladolid.....	Sept. 13-26.....	1	0	0
Vera Cruz.....	Sept. 27-Oct. 3.....	45	0	0
Venezuela, Caracas.....	Sept. 15.....	1	0	0
CHOLERA—INSULAR.				
Philippine Islands, Manila.....	Aug. 22-20.....	10	0	0
Provinces.....	Aug. 22-20.....	1,503	1,262	0
CHOLERA—FOREIGN.				
China, Shanghai.....	Aug. 22-20.....	9	0	0
India, Calcutta.....	Sept. 6-12.....	4	0	0
Madras.....	Sept. 5-11.....	2	0	0
Turkey, Syria.....	Sept. 1-14.....	473	317	0
Straits Settlements, Singapore.....	Aug. 23-20.....	7	0	0
PLAGUE—INSULAR.				
Philippine Islands, Manila.....	Aug. 22-20.....	2	1	0
PLAGUE—FOREIGN.				
Egypt, Alexandria.....	Sept. 5-11.....	10	5	0
Damiette.....	Sept. 5-11.....	1	0	0
France, Marseilles.....	To Sept. 15.....	0	1	0
India, Bombay.....	Sept. 2-15.....	142	0	0
Calcutta.....	Sept. 6-12.....	13	0	0
Japan, Yokohama.....	Aug. 22-Sept. 12.....	4	3	0

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Original Articles.

HIGH-FREQUENCY CURRENTS.*

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IF an electric current alternates or oscillates at a rate of a million times or more per second, it may with propriety be termed a "high-frequency" current. Such a current was introduced into practical medicine by Dr. William J. Morton in 1881.† It enjoyed a certain measure of vogue among those who employed static electricity in the treatment of disease, but its use was somewhat curtailed by the subsequent introduction by Dr. Morton of what is known as the "wave" current. This appeared to possess a wider field of usefulness than the earlier current to which the name Static or Franklinic induced current had been applied.

The brilliant experiments of Tesla with high power, high-frequency currents, induced D'Arsonval of Paris to study them carefully with a view to their utilization for therapeutic purposes. The result was the introduction of his high-frequency apparatus, the currents from which have been shown to produce very remarkable and very desirable results. It is to the currents from this apparatus with its various subsidiary appliances that the term "High-frequency" should be confined and is confined by all European authors.

I urge this, as high-frequency currents can be produced in various ways, but the currents themselves differ materially in character and can hardly be expected to produce exactly the same effects.

Three years ago I introduced still another high-frequency current, to which I gave the name "hyperstatic," in order to indicate its origin, and also to prevent its being confounded with the high-frequency current of D'Arsonval.‡

In order to make the matter clear I will indicate the manner in which these several currents are produced. To obtain the Morton "Static-induced" current you attach the leyden jars in the usual manner to a static machine. Then connect the patient to the outer armatures of the jars. Bring the sliding poles into contact and start the machine. Then separate the poles a short distance (say an eighth of an inch). The patient will now experience a slight sensation. If the spark-gap be-

*Read at a meeting of the Medical Society of the County of New York, September 28, 1903.

†Recent experiments by Dr. Manders (*Medical Electricity and Radiology*, July, 1903) appear to throw some doubt on this statement. According to this writer, the Morton arrangement gives rise to an interrupted, unidirectional current, and not to an alternating or oscillating one.

‡My hyperstatic transformer was at first made with the coarse wire inside the fine or secondary winding, the two being separated by modified form of the Tesla insulation. It was soon found better to reverse the arrangement, and to place the coarse winding outside the finer and using glass for dielectric. D'Arsonval also, in 1900, introduced his "Nouvelle bobine bipolaire," which involves a similar arrangement except that he depends on air instead of glass as the dielectric.

tween the poles be increased to a quarter of an inch, distinct muscular contractions will take place, and if the gap be further increased the limit of the patient's endurance will soon be reached.

The D'Arsonval apparatus consists essentially of the following parts: (1) A good high-tension spark coil rated at eight or ten inches; (2) an efficient interrupter in the primary circuit; (3) Leyden jars or some other form of condenser of suitable capacity and (4) a solenoid. In other words, the simple addition of a solenoid to any x-ray outfit.

If the reader wishes to understand fully the D'Arsonval current let him connect the Leyden jars or other condenser to a static machine or coil. If now he takes a piece of wire and coils it helically so as to convert it into a solenoid, and attaches it to the outer coats of the jars with the electrodes attached to the same points and holds one in each hand, he will experience no sensation, but he must not deceive himself with the idea that there is "nothing doing," for if he will bring his hands close together, say within a quarter of an inch of each other, he will be promptly convinced to the contrary. This current which traverses the patient without giving rise to any special sensation is D'Arsonval's high-frequency current, and the only current to which, under this name, the European literature of the last ten years applies. It is only obtained when the patient is in a circuit *in shunt* to a suitable conductor connecting the external armatures of the condensers. It will be noted that there is *no spark gap* in the circuit of which the patient forms a part. The fact that a strong current passes through the body when in shunt to the solenoid may at first appear a matter of surprise, but it is due to the heavy impedance developed in the solenoid by the self-induction of the several coils of the solenoid on each other. In France an induction coil is universally employed in generating the D'Arsonval high-frequency current, probably because they have excellent coils in France, while their static machines are mere toys compared with those commonly used in this country. There is, however, a distinct difference between the high-frequency current from a coil and one from a good (American) static machine. The latter gives a current of higher voltage, but lower amperage.

D'Arsonval uses his high-frequency current direct from the solenoid, or in connection with two important subsidiary appliances. One of these is his condenser couch,§ which appears to me to be of but limited usefulness as compared with his large solenoid. This latter is about thirty inches in diameter and five or six feet high, large enough, in fact, to surround the patient without being in contact with him at any point. The terminals of the large solenoid are connected to those of the small solenoid,

§A condenser couch can be readily arranged by taking a cheap examining table and laying a sheet of metal or wire gauze on the middle part. On this is spread two or three layers of cotton felt, over this again the thin mattresses or cushions that come with the table. The total expense need not exceed twenty-five dollars. Mr. Chisholm Williams has used the condenser couch with apparent benefit in the treatment of pulmonary tuberculosis.

and the passing current induces a corresponding current in the body of the patient within the coil. Physiological experiments by D'Arsonval and others have shown that the current induced by the large solenoid notably increases the respiratory exchanges, the excretion of the urinary solids (including urea, uric, and phosphoric acids), the toxicity of the urine, and the radiation of heat from the body. In other words, there is a decided increase in the general metabolism, or as a French writer expresses it: "*Une suractivité plus grande des combustions organiques.*"

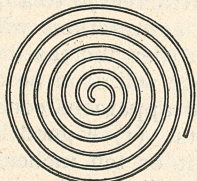


FIG. 1.—Spiral.

When we consider the large number of affections now recognized as depending on or accompanied by defective or retarded catabolism, the physiological data above given will readily indicate the therapeutic measures that may with confidence be pursued.

In 1893 Oudin of Paris connected his "resonator" to the D'Arsonval small solenoid, and in this way materially increased the potential of the current. Its chief use is in the local treatment of diseases of the skin.

My own hyperstatic transformer (MEDICAL RECORD, October 20, 1900) gives a high-frequency current, but it differs from the D'Arsonval current by its higher voltage. I have used this current only for the local modification of lesions and for its derivative effects. Whether it possesses any constitutional action or is capable of in any way modifying metabolism, I do not know. When I have desired to influence nutrition or to stimulate metabolism by means of high-tension currents I have availed myself either of static electricity pure and simple, or have used the D'Arsonval current.

The fact that an insensible current (*i.e.* one that cannot be felt) produces such sensible effects has as yet received no adequate explanation. The fact, however, remains, and a very ready and convenient means of demonstrating it, is to put an ordinary 16 c. p. 110 volt lamp in series with the

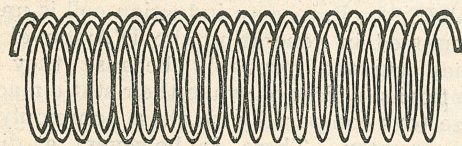


FIG. 2.—Solenoid.

human body, and passing the current derived from the small D'Arsonval solenoid. With a current of, say, six amperes traversing the primary of an eight-inch coil, the filament of the lamp will immediately become of a bright cherry red, and without causing the slightest sensation in the person through whom the current is passing. This means a current of between two or three hundred milliamperes. If a direct current of equal strength were passing, the electrodes would cause an unbearable burning pain, while if an alternating current of low frequency (a few hundred alternations per second) were used, there would be intense tetanization of the muscles.*

*The remarkable difference between the effects of low tension direct, and high-tension high-frequency alternating currents is well exemplified in the transmission of ocean messages. If a low-tension current is used, as from a large battery or dynamo, a metallic conductor traversing the sea must be employed. A high-frequency current, however, will flash the message over the ocean without the need of intermediate wires.

Having used the D'Arsonval methods to a considerable extent, and having become thoroughly satisfied as to their potency in local lesions and their great value in improving the general metabolism, it yet seemed that some slight improvement might be made in the electrical technique, still preserving the essential D'Arsonval feature—that is, placing the patient in shunt to the current passing through the small solenoid. To this end I substituted a spiral† for a helix, and after many experiments with spirals of copper, brass, aluminum, iron, and steel finally found one that gave me results superior to those obtained with the D'Arsonval helix—the superiority being due to the fact that the self-induction and impedance was greater with the spiral than with the helix, and the shunt current consequently stronger.

The spiral that I have found most satisfactory is seven inches in diameter and nine inches and a half in height, including the base. When used with the static machine, place the largest jars in position and connect the terminals of the spiral with the outer coatings of the jars, with the electrode cords connected to the same points. The subsequent technique is that of D'Arsonval, which, briefly stated, consists in (1) applying both electrodes (metallic preferred) to the patient; (2) connecting one in-

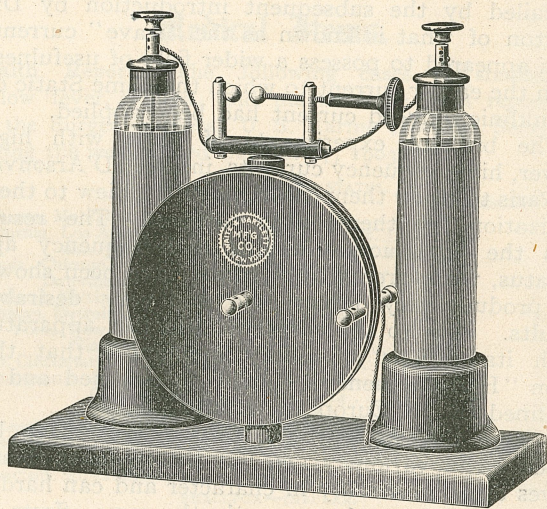


FIG. 3.—The author's high-frequency spiral for use with an x-ray coil.

different electrode (metallic) to the patient and bring a vacuum tube‡ near or in contact with the part that we desire to modify locally; (3) connecting one pole to D'Arsonval condenser-couch, the other pole being brought into contact with some part of the patient's body; (4) connecting the two poles with the terminals of D'Arsonval large solenoid or cage.

If the spiral is to be used in connection with an x-ray coil medium-sized jars are mounted on the same base with the spiral, the terminals of which are already connected with the outer coatings of the jars. (Fig. 3.) The inner coatings of the jars are then connected to the terminals of the secondary coil, and the apparatus is brought into action with such spark-gap between the secondaries as may be found

†A spiral is defined by the Standard Dictionary as follows: "Any plane curve formed by a point that moves around a fixed center and continually increases its distance from it." This is shown in Fig. 1. The solenoid or helicoidal employed by D'Arsonval is of the form shown in Fig. 2.

‡The use of vacuum tubes in connection with the therapeutic application of high-frequency currents is a purely American development, and the credit for their introduction belongs, I believe, to Dr. F. F. Strong of Boston. They are but little used or known in France or Germany, but have gained some favor in England.

necessary. If two identical spirals are used one with a coil and the other with a static machine, the resulting shunt currents will not be identical—the former having the higher amperage and lower voltage.

The large solenoid of D'Arsonval is open at the top, but in the one I have had made for my own use the wire is continued in the form of a horizontal spiral, forming in this way a top to the cage. (Fig. 4.) It increases the auto-induction and adds to the efficiency of the apparatus. If a current of six or eight amperes be passed through the primary of the x-ray coil, the patient within the cage will experience but little sensation, although a powerful current is circulating through him. This will be readily demonstrated if he will hold the outer terminal of an Edison 16 c.p. 110 volt lamp between his finger and thumb, and touch the inner or central terminal to one of the upper wires of the cage. The carbon filament immediately becomes

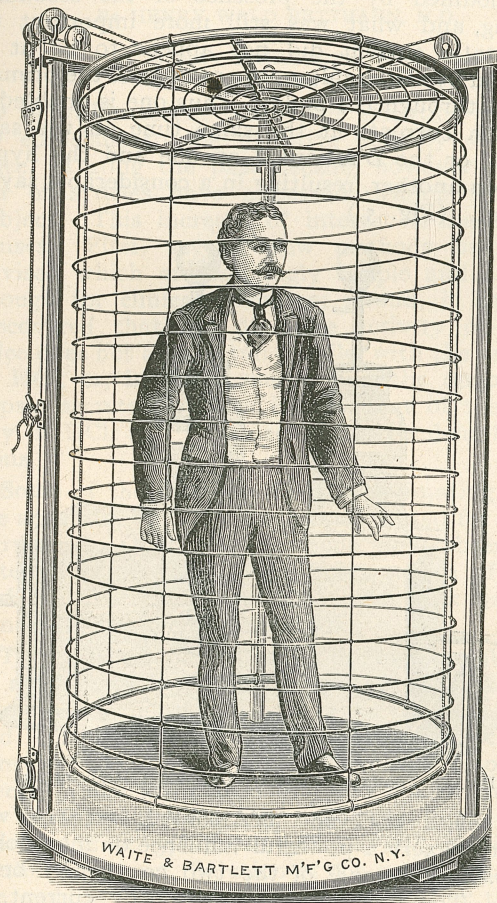


FIG. 4.—The author's resonator or combined spiral and solenoid.

of a bright red. The spark-gap between the terminals of secondary of the coil need not exceed one-half of an inch. If longer than this the lamp will short circuit inside, or, as sometimes happens, the lamp filament will instantly flash to a full brilliance and then break.

If, instead of connecting as above, one pole of the small solenoid or the author's small spiral be connected with the central terminal of the large flat spiral forming the roof of the cage, and the other pole to the point where the spiral joins the large solenoid, the induction effects are intensified as the arrangement now constitutes a large Resonator with the patient inside of it, instead of outside as with the Oudin. A still more intense effect is obtained if the small solenoid or spiral be omitted, and the outer and inner ends of the top spiral be connected directly to the outer armatures of the condenser (leyden jars). With the latter arrange-

ment a longer spark-gap can be used. If connecting cords and electrodes are connected with any of the turns of the large coil, a regular D'Arsonval current with its secondary applications may be administered to one or more patients outside the solenoid, whether there is one within it or not; and this with but little apparent diminution of the intensity of the induced current within the cage.

I have not clinically used the large D'Arsonval solenoid in connection with a high-frequency current derived from a static machine, as my office arrangements will not conveniently permit of this combination. Experimentally it works in a satisfactory manner.

The very manifest difference between the wave-current of Morton and the high-frequency current of D'Arsonval immediately suggests the query as to the relative merits of the two in respect to their influence on metabolism. Clinical experience abundantly establishes the fact that both currents administered with care and judgment are capable of improving the various functional activities, including the respiratory, the thermogenic, and those relating to the conversion of ingesta into ejecta, be the same solid, fluid, or gaseous. The results of physiological experiment have shown the same in respect to the D'Arsonval currents, but I do not find that static electricity has been subjected to the same careful tests. Quite recently, however, some very careful and painstaking experiments with static electricity by MM. Maitre and Florence of Montpellier (*Archives d'Électricité Médicale*, April, 1903) have demonstrated that so far as the urinary secretion is concerned, the effects are similar in character but less in degree than those observed by D'Arsonval and others in connection with high-frequency currents. The machine employed consisted of two plates, capable of giving a spark of ten inches. It is to be regretted that the experimenters did not employ a more efficient apparatus. If this had been done it is quite possible that the metabolic results would have equalled, and perhaps surpassed, those obtained with the D'Arsonval system.*

It is now three years since I introduced the Hyperstatic Transformer for the local treatment of certain cutaneous lesions, and so far as I can learn the apparatus has given satisfaction to those who have used it. Some, however, I find do not appear to understand fully its capabilities or how to use it to

*One of the earliest static machines constructed in America for therapeutic purposes was copied, I believe, from one imported from France, and it is not a little surprising that the French have been so backward in the further development of this apparatus. The current advertisement of a somewhat prominent French manufacturer offers a "*Machine Statique a Grand Débit*," which consists of two pairs of plates twenty-two inches in diameter! A toy like this would not be seen in an American office, where it would be difficult to find a static machine with fewer than eight pairs of plates of thirty inches diameter. Static machines of the Wimshurst type are the ones commonly used in Europe, and in this type each pair of plates requires a separate belt. If a large number of plates are mounted it is almost impossible to secure uniform rapidity of rotation, which greatly impairs the efficiency of the machine. In this country the Wimshurst is not manufactured for therapeutic purposes, but the prevailing types are the Holtz and the Toepler-Holtz. The latter is self-exciting and proves attractive to some, on that account, as well as by reason of the lower price at which it can be manufactured, but the writer's experience with it is far from being as satisfactory as with the Holtz machine, which requires an independent exciter. If a Holtz and a Toepler-Holtz have equal areas of revolving surface, the output of current will be greater from the Holtz; when in action the Holtz machine will not change polarity, which the Toepler-Holtz is liable to do, especially when under a heavy load, when using the wave current or a high-resistance x-ray tube.

the best advantage. To these I offer the following suggestions:

Having connected the transformer to the static machine (with poles in contact), turn on the power, and when the plates are revolving at about 300 or 350 times a minute, separate the poles about an inch. If the hand be brought near one of the terminals of the transformer, it will be met by a diffuse electric spray (*effluve* of the French). The same will occur when the hand approaches the other terminal, but it will be noticed that the spray is more intense at one of the terminals than at the other, and it will be found that the stronger spray will be opposite the positive pole of the static machine. I usually connect the electrode with this terminal. If a very mild effect is desired the other terminal of the transformer is left free. If a stronger effect is desired the inactive terminal is grounded, and if still more action is required this terminal is connected with some part of the patient's person. The strength of the current may be further modified by using a longer or shorter spark-gap. After studying the effect of the spray the electrode should be brought nearer the skin, and when sufficiently near, bright sparks will shoot forth to be replaced by a multitude of fine sparks when the electrode is brought in direct contact with the skin. The best spray effect and also the strongest sparks are obtained when using an electrode with a metal point. The most generally useful electrodes, however, are glass vacuum tubes. I use a dozen or more of these, of shapes adapted to the particular requirements of the case. Some are of low and others are of comparatively high vacuum.

The transformer may be used with an x-ray coil by connecting it to the terminals of the secondary wire of the coil and adjusting the spark-gap of the coil so that the length of the spark shall be one-half inch or less. As the current delivered by the coil differs from that of the static machine (being of higher amperage and lower voltage), the current from the transformer will be somewhat modified. The spray will be shorter, more compact, and finer; while from the vacuum tubes the sparks are much finer and more numerous. On the whole, I find the current from the transformer connected with the static machine more effective than when connected with the coil. If the experiments are conducted in a darkened room the luminous effects are very striking.

As I have endeavored to make clear, the functions of the hyperstatic and the D'Arsonval currents are quite different and distinct—the former being chiefly useful for local applications while the latter is capable of distinctly influencing the general system.

Nearly thirty years ago the writer became fully satisfied that in the majority of cases of chronic eczema there co-existed a condition of the system characterized by defective elimination of catabolic products, and he so expressed himself as fully as the facts then appeared to warrant.*

From that time to the present I have found no good reason to question soundness of the views then put forth, although they have not been generally accepted by dermatologists, many of whom are inclined to attribute the phenomena that accompany eczema to a local pathogeny.

If we rely on drugs to facilitate the elimination of these "*materies morbi*," or elements of auto-intoxication, we have at command diuretics, cathartics, diaphoretics, alkalies, and substances belonging

*"An Elementary Treatise on Diseases of the Skin," Macmillan & Co., London and New York, 1876.

to the salicylic group, but none of these has in my hands yielded results as satisfactory as may be obtained from high tension electricity, whether through the Morton wave or the D'Arsonval high-frequency currents.

When I have desired to obtain both the constitutional and local effects of high-tension electricity, I have until recently employed the wave or the D'Arsonval followed or preceded by the hyperstatic. This in many instances was tedious and time-consuming.

It then occurred to me to put binding-posts on the outside of the hyperstatic case and connect them with the terminals of the primary coil, leaving all other connections as before. If a patient be now introduced into this primary circuit he will receive the pure D'Arsonval current, and a 16 c. p. lamp placed in series will become incandescent. I could not obtain any evidence that the primary circuit was modified by the presence of the secondary winding, and what was still more important the hyperstatic current did not appear to be at all impaired by the simultaneous passage of the primary current through the body. Thus one is enabled to use both currents at the same time on the same subject, or the D'Arsonval on one and the hyperstatic on another, resulting in a considerable saving of time. (Fig. 5.)

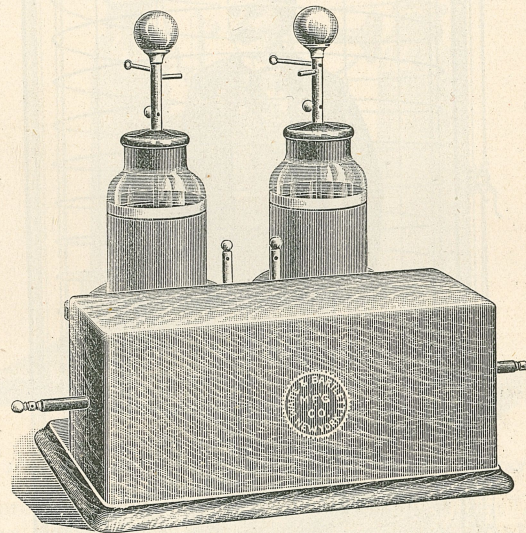


FIG. 5.—The author's improved hyperstatic transformer.

Although both the D'Arsonval and the wave currents exert a powerful influence on metabolism, the *modus operandi* of the two can hardly be the same. The first is a high-frequency current, the second is not. In the first the spark-gap will rarely exceed an inch, and in the second a gap of eight or ten inches is frequently employed. In the first there may be absolutely no sensation while the current is passing—in the second there is a vibratory sensation and the hair stands out from the scalp. After the passage of the D'Arsonval current for ten or fifteen minutes there may be but little change in the feelings of the patient—after the wave current there is generally a feeling of exhilaration and an apparent increase of energy. What changes then occur in the body during the passages of these currents, and in what way are their beneficial effects brought about? To these questions no certain answer can be given. In default of such, it seems reasonable to suppose that the wave current acts through a sort of molecular vibration or cellular massage, while the D'Arsonval may act through the development of heat in the tissues. A current that is capable of bringing the lamp filament to incandescence must of necessity develop more or

less heat when traversing bodies that offer a similar high resistance to its passage.

The hasty sketch I have here given of the high-frequency currents is intended simply to attract attention to therapeutic agencies that I consider of high importance, and to encourage further research as to their general utility. The reader who desires to obtain a thorough working knowledge of the D'Arsonval current is earnestly advised to read Denoyés' "Les Courants de Haute Fréquence," Paris, 1902; the chapter on "Hochfrequenzströme" (70 pages) contained in Freund's "Grundriss der gesamten Radiotherapie," Berlin, 1903; or Chisholm Williams' "High-frequency Currents in the Treatment of Some Diseases," London, 1903.

250 WEST FIFTY-SEVENTH STREET.

TWO NEW METHODS OF DETERMINING THE DIGESTIVE ACTIVITY OF GASTRIC JUICE.*

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Up to within recent years little attention was paid by clinicians to the digestive activity of gastric juice. During the past decade, however, a number of articles have appeared dealing with this subject. This increase of interest is due to two causes: First, several new methods have been devised which are seemingly simple and accurate enough for clinical purposes; second, it has been discovered that the digestive activity of gastric juice does not always run parallel with the secretion of HCl; or, in other words, that the quantity of pepsin secreted is often independent of the quantity of HCl, and is subject to independent fluctuations.

Some of the older methods of estimating pepsin are accurate, but all are too complicated for clinical purposes.† Only two methods have been used extensively for clinical purposes, those of Mette and Hammerschlag, and all recent work has been done with one of these methods.

The method of Mette, as originally published, is as follows:‡ "Fluid eggwhite is sucked up into a fine glass tube of 1 to 2 mm. lumen, and coagulated therein at a definite temperature (95° C.). The tube is then cut into small pieces, which are placed in 1 or 2 c.c. of the fluid to be investigated. The whole is kept in the thermostat at 37° C. to 38° C., and requires no further watching. Solution of the proteid occurs at the ends of the small glass tubes. After the termination of a certain period the length of the pieces of tube and that of the undigested remains of the proteid columns are measured off with the aid of a mm. scale and a microscope of low magnifying power. The difference gives the length of the digested proteid cylinders in mms. and fractions of a mm. This method leaves nothing to be desired so far as convenience of application and clearness with exactness of results are concerned. Test experiments specially carried out (Dr. Ssamojloff) have convinced us that the digestion of the proteid columns—at least within the first ten hours (employing the fluids which we have to deal with)—is directly proportionate to the length of the period. This was the case even when the

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†A history of these methods is given by Schorlemmer and by Van Valzah-Nisbet.

‡This description is copied verbatim from Thompson's translation from Pawlow, "The Work of the Digestive Glands."

fluid possessed its highest digesting power. These experiments did away with the very natural mistrust that the solution of the proteids may proceed at varying rates at different depths of the tubes, dependent on more or less stagnation of the digestive products within the lumen. It may, therefore be accepted that the length in mm. of eggwhite dissolved by the several juices in a certain time gives us an exact relative measure of the digestive power of the fluid. In the researches of Borissow, carried out upon this question in the laboratory of Professor Tarchanoff, the relation which lies at the basis of the connection between the length of the digested column of eggwhite and the pepsin contents of the fluid under investigation came out with perfect clearness. The following is the rule which expresses it, viz., *The quantity of pepsin in the compared fluids is proportionate to the square of the rapidity of digestion, i. e. to the square of the column expressed in mm.* which the juices are capable of digesting in the same period of time. An example in figures will make this clear. If one of the fluids digests a column of 2 mm. of proteid, and the other a column of 3 mm., the relative quantity of pepsin in each is not expressed by the figures 2 and 3 respectively, but by the squares of these numbers, i. e. by 4 and 9. This rule has, of course, been deduced from comparisons made with numerous artificial solutions of pepsin exactly prepared. Moreover, the result which Dr. Borissow arrived at independently had already been discovered before him by Schütz from polarimetric observation of the amounts of peptone formed during the digestion of eggwhite. This correspondence in the data furnished by different methods affords strong assurance of the correctness of the rule. . . .

"We have still to add that the diameter of the tubes even within wide limits is without importance, and that the white of the hen's egg is of sufficiently constant composition to be employed as a test object for the purpose."

The method of Hammerschlag is carried out as follows: A c. 1 per cent. solution of egg albumen is prepared in the following way: 3.0 g. of albumen ovi sicc. is rubbed up with lukewarm water in a mortar, and then water is added to make the total quantity 150 to 180 c.c. This solution is filtered and officinal HCl is added until the solution contains 3 to 4 per cent. free HCl (as tested by titrating with $\frac{N}{10}$ KOH with dimethylamidoazobenzol as indicator). Ten c.c. of this acidified solution is now mixed with 5 c.c. of the gastric juice to be tested and another 10 c.c. is mixed with 5 c.c. of distilled water to serve as a control test. These mixtures are placed in two Esbach tubes, which they exactly fill up to the mark U, and are placed in the thermostat at body temperature for one hour. After one hour they are removed, and Esbach reagent is poured into the tubes up to the mark R. The tubes are inverted several times and then let stand twenty-four hours at ordinary room temperature. The sediment shows the amount of albumen present; in the control tube the original amount of albumen is shown. In the other tube the albumen which has escaped digestion is shown. Thus the proportion of albumen digestion is easily estimated. Hammerschlag says that normal gastric juice digests 80 to 95 per cent. of the albumen in one hour.

Both methods have been used by a number of observers during the past ten years. The necessity for further and more critical work is shown by the variety of the conclusions reached. It is generally conceded that, for clinical purposes,